# DRAFT

# Tactical Control System (TCS)

# to

# Joint Service Imagery Processing System - Navy

# (JSIPS-N)

# Interface Design Description

Contract Number N00178-95-D-2018

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Prepared for:
Program Executive Officer, Cruise Missiles Project
and Unmanned Air Vehicles Joint Project

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**Version 1.0 DRAFT**

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# CHANGE RECORD

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| Tactical Control System (TCS) to<br>Joint Service Imagery Processing System - Navy | TCS 210 |

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# 1. Scope.

This Interface Design Description (IDD) defines the interface between the Tactical Control System (TCS) and the Joint Service Imagery Processing System - Navy (JSIPS-N).

## 1.1 Identification.

This TCS IDD Version 1.0 identifies, specifies, and establishes the detailed interface requirements between the TCS and the JSIPS-N as set forth by both the TCS System/Subsystem Specification (SSS) Version 1.0 and the TCS System/Subsystem Design Description (SSDD) Version 1.0. This IDD is written to comply with the TCS Operational Requirements Document (ORD) requirement number ORD069. This IDD details the interface of the TCS to the Precision Targeting Workstation (PTW) segment of JSIPS-N. Versions of the JSIPS-N PTW segment are identified in the appendices. This IDD specifies requirements levied on the TCS, and does not impose any requirements on the JSIPS-N. This IDD further specifies the methods to be used to ensure that each system interface requirement has been met. This IDD is published in accordance with Data Item Description (DID) DI-IPSC-81436, dated 05 December 1994, and modified to incorporate the qualification provisions section that is traditionally found in the Interface Requirements Specification (IRS). This IDD will be revised at the conclusion of the Program Definition and Risk Reduction period of the TCS program and will be re-issued in final form to be used during the follow-on TCS Engineering and Manufacturing Development period.

## 1.2 System Overview.

The purpose of the TCS is to provide the military services with a single command, control, data receipt, data processing, data export and dissemination capability that is interoperable with the family of all present and future tactical unmanned aerial vehicles (UAVs) and with designated Command, Control, Communication, Computers, and Intelligence ($C^4I$) systems. These UAVs include the Tactical Unmanned Aerial Vehicle (TUAV) and the Medium Altitude Endurance (MAE) UAV (henceforth referred to as Outrider and Predator respectively), with their associated payloads. Designated $C^4I$ and other systems that TCS will be interoperable with are detailed in paragraph 1.2.2.4. TCS will also be capable of receiving and processing information from High Altitude Endurance (HAE) UAVs and their associated payloads, as well as being capable of providing interoperability with future development tactical UAVs and payloads.

### 1.2.1 TCS Program, Phases, and UAV Interaction.

The Unmanned Aerial Vehicle Joint Project Office (UAV JPO) has undertaken development of a TCS for UAVs. Design and development of the TCS will be conducted in two phases. Phase 1 is defined as the Program Definition and Risk Reduction phase, and Phase 2 is defined as the Engineering and Manufacturing Development phase in accordance with Department of Defense Instruction (DoDI) - 5000.2R. During Phase 2, TCS Low Rate Initial Production (LRIP) will commence. Phase 1 is a 24 month period that demonstrates Level 1 through Level 5 interaction (as defined below) in an Incremental and Evolutionary strategy as described in accordance with MIL-STD-498. The five discrete levels of multiple UAV interaction to be provided by the TCS

are:

Level 1: receipt and transmission of secondary imagery and/or data

Level 2: direct receipt of imagery and/or data

Level 3: control of the UAV payload in addition to direct receipt of imagery/data

Level 4: control of the UAV, less launch and recovery, plus all the functions of level 3

Level 5: capability to have full function and control of the UAV from takeoff to landing

### 1.2.2 Tactical Control System Overview.

The TCS is the software, software-related hardware and the extra ground support hardware necessary for the control of the TUAV, the MAE UAV, and future tactical UAVs. The TCS will also provide connectivity to specific $C^4I$ systems as outlined in paragraph 1.2.2.4. TCS will have the objective capability of receiving HAE UAV payload information. Although developed as a total package, the TCS will be scaleable to meet the users' requirements for deployment. TCS will provide a common Human-Computer Interface (HCI) for tactical airborne platforms to simplify user operations and training, and to facilitate seamless integration into the Services' Joint $C^4I$ infrastructure across all levels of interaction.

#### 1.2.2.1 Software.

The major focus of the TCS program is software. The software will provide the UAV operator with the necessary tools for computer related communications, mission tasking, mission planning, mission execution, data receipt, data processing, limited data exploitation, and data dissemination. The software will provide a high resolution, computer-generated graphics user interface that enables a UAV operator trained on one system to control different types of UAVs or UAV payloads with a minimum of additional training. The TCS will operate in an open architecture and be capable of being hosted on computers that are typically supported by the using Service. Software developed will be Defense Information Infrastructure/Common Operating Environment (DII/COE) compliant, non-proprietary, and the architectural standard for all future tactical UAVs. To the extent possible, the TCS will use standard Department of Defense (DoD) software components to achieve commonality. TCS will provide software portability, scaleable functionality, and support for operational configurations tailored to users' needs.

#### 1.2.2.2 Hardware.

To the extent possible, TCS will use standard DoD components in order to achieve commonality. TCS will use the computing hardware specified by the service specific procurement contracts. The individual armed services will identify TCS computing hardware, the desired level of TCS functionality, the battlefield $C^4I$ connectivity, and the particular type of air vehicle and payloads

to be operated depending upon the deployment concept and area of operations. TCS hardware must be capable of being scaled or modularized to meet varying Service needs. TCS hardware will permit long range communications from one TCS to another, data storage expansion, access to other computers to share in processing capability, and multiple external peripherals.

#### 1.2.2.3 System Compliance.

The TCS will be developed in compliance with the following military and commercial computing systems architecture, communications processing, and imagery architecture standards:

a. Department of Defense Joint Technical Architecture (JTA), including, but not limited to:
   - Variable Message Format (VMF) and Joint Message Format (JMF)
   - National Imagery Transmission Format (NITF)

b. Defense Information Infrastructure/Common Operating Environment

c. Computer Open Systems Interface Processor (COSIP)

d. Common Imagery Ground/Surface System (CIGSS) segment of the Distributed Common Ground Station (DCGS).

#### 1.2.2.4 Integration with Joint $C^4I$ Systems.

TCS will be capable of entering DII/COE compliant networks and TCS integration with $C^4I$ systems will be accomplished through development of interfaces that permit information exchange between the TCS and specified $C^4I$ systems. Network interoperability will include but not be limited to:

Advanced Field Artillery Tactical Data System (AFATDS)

Advanced Tomahawk Weapons Control System (ATWCS)

Air Force Mission Support System (AFMSS)

All Source Analysis System (ASAS)

Army Mission Planning System (AMPS)

Automated Target Handoff System (ATHS)

Closed Circuit Television (CCTV)

Common Operational Modeling, Planning, and Simulation Strategy (COMPASS)

Contingency Airborne Reconnaissance System (CARS)

Enhanced Tactical Radar Correlator (ETRAC)

Guardrail Common Sensor/Aerial Common Sensor (ACS) Integrated Processing Facility (IPF)

Intelligence Analysis System (IAS)

Joint Deployable Intelligence Support System (JDISS)

Joint Maritime Command Information System (JMCIS)

Joint Service Imagery Processing System - Air Force (JSIPS)

Joint Service Imagery Processing System - Navy (JSIPS-N)

Joint Surveillance Target Attack Radar System (JSTARS) Ground Station Module/Common Ground Station (GSM/CGS)

Modernized Imagery Exploitation System (MIES)

Tactical Aircraft Mission Planning System (TAMPS)

Tactical Exploitation Group (TEG)

Tactical Exploitation System (TES)

Theater Battle Management Core System (TBMCS)

TROJAN Special Purpose Integrated Remote Intelligence Terminal (SPIRIT) II

The TCS will export and disseminate UAV imagery products, tactical communication messages, as well as mission plans and target coordinates. TCS will also receive, process, and display tasking orders and operational information from service specific mission planning systems.

### 1.2.3 JSIPS-N System Overview.

The JSIPS-N is becoming operational on all Navy aircraft carriers and various amphibious assault ships plus several ashore installations and Rapid Deployment Suites. For the first time, Navy commanders will have the capability to rapidly plan and execute precision strike missions in a true sensor-to-shooter environment. JSIPS-N provides the capability to receive imagery in real/near real-time from virtually any source, national or tactical, and in virtually any format. JSIPS-N enables the creation of timely, highly accurate imagery information. It supports the rapid exploitation and dissemination of imagery products to meet staff, mission planning and intelligence requirements. JSIPS-N is introduced into the fleet today and will give the U.S. Navy unprecedented capability in the employment of precision strike weapons. Ashore or afloat, the U.S. Navy will be able to create the electronic target folders and target reference scenes, create the perspective scenes required for mission preview and rehearsal, and create accurate, precisely mensurated imagery products to support all strike warfare requirements. The JSIPS-N (PTW Segment) will be DII/COE compliant to level five when the final interface to TCS is implemented.

## 1.3 Document Overview.

The purpose of this IDD is to provide the interface description between the TCS and the JSIPS-N. This document was developed using MIL-STD-498 (Data Item Description DI-IPSC-84136) as a guide, and is divided into the following sections:

| | |
|---|---|
| Section 1 | Scope: Identifies the systems, interfacing entities, and interfaces addressed in this IDD; with a brief overview of each. |
| Section 2 | Referenced Documents: Lists all referenced documents applicable to this development effort. |
| Section 3 | Interface Design: Identifies and describes the characteristics of the interface(s) defined in this IDD. |
| Section 4 | Requirements Traceability and Qualification Provisions: Defines the requirements traceability to the TCS SSDD, and also defines the qualification methods which are used to ensure that each requirement of this interface has been met. |
| Section 5 | Notes: Provides background information regarding JSIPS-N; and a list of acronyms and abbreviations used in this IDD. |
| Appendices | A: For Version 1.7 of PTW.<br>B: For Version 3.1 of PTW. |

## 2. Referenced Documents.

### 2.1 Government Documents.

The following documents of the exact issue shown form part of this IDD to the extent specified herein. In the event of conflict between the documents referenced herein and the content of this IDD, the content of this IDD will be considered a superseding requirement.

#### 2.1.1 Specifications.

| | |
|---|---|
| TCS 102<br>30 June 1997 | Tactical Control System, System/Subsystem Specification, Version 1.0 |
| TCS 104<br>Date - TBD | Tactical Control System, System/Subsystem Design Description, Version 1.0 |
| TCS 229<br>20 Nov 1997 | Tactical Control System Segment to Air Vehicle Standard Segment Interface Design Description, Version 1.1 |

#### 2.1.2 Standards.

Federal - None

Military

| | |
|---|---|
| DOD JTA<br>22 Aug 1996 | DoD Joint Technical Architecture, Version 1.0 |
| MIL-STD-498<br>5 Dec 1994 | Software Development and Documentation Standard |
| MIL-STD-2500A<br>12 Oct 1994 | National Imagery Transmission Format Standard (Ver 2.0) |

Other Government Agency - None

#### 2.1.3 Drawings.

None

**2.1.4 Other Publications.**

Reports

| | |
|---|---|
| TCS 100<br>Data - TBD | Operational Concept Document for the TCS (Draft) |
| TCS 118<br>7 July 1997 | Tactical Control System, Operational Requirements Document, Version 5.0 |
| TCS 233<br>9 May 1997 | Tactical Control System Joint Interoperability Interface 2, Version 1.0, TCS to Service $C^4I$ Systems |

Regulations - None

Handbooks

| | |
|---|---|
| CIGSS-HDBK<br>19 July 1995 | CIGSS Acquisition Standards Handbook, Version 1.0 |
| MIL-HDBK-1300A<br>12 Oct 1994 | National Imagery Transmission Format |

Bulletins - None

**2.2 Non-Government Documents.**

The following documents of the exact issue shown form part of this IDD to the extent specified herein. In the event of conflict between the documents referenced herein and the content of this IDD, the content of this IDD will be considered a superseding requirement.

**2.2.1 Specifications.**

None

**2.2.2 Standards.**

None

**2.2.3 Drawings.**

None

**2.2.4 Other Publications.**

None

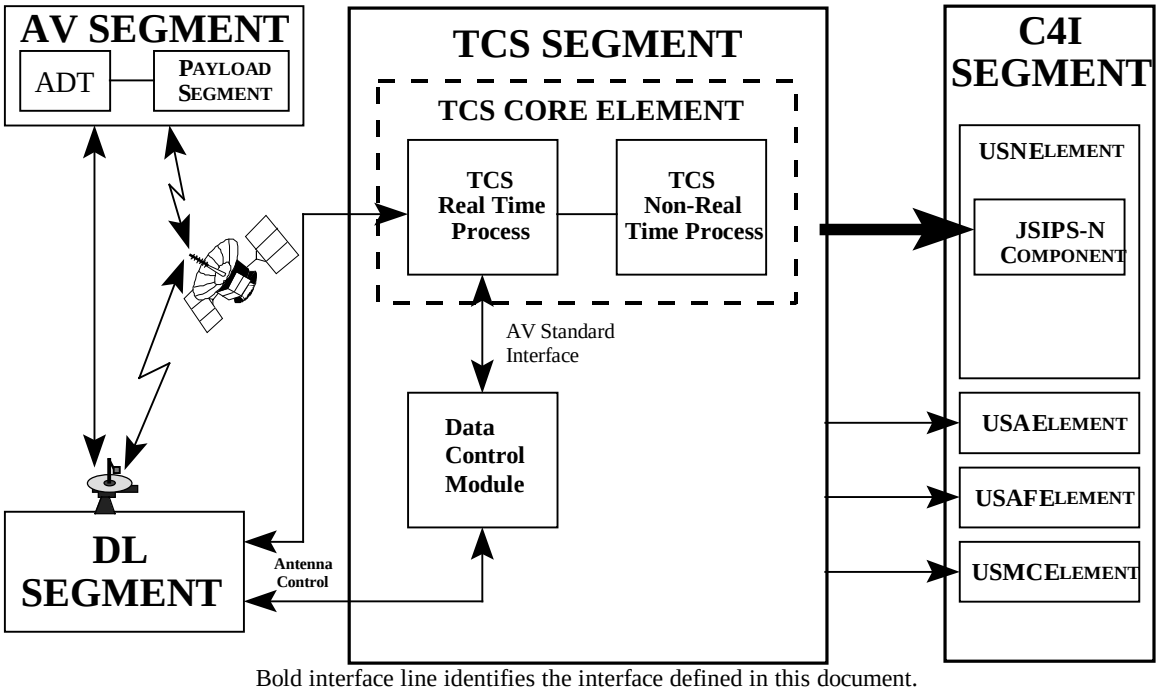
## 3. Interface Design.

The interface between the TCS and JSIPS-N is through the PTW. The PTW will use data received from the TCS to prepare Task Assignments for the Digital Imagery WorkStation Afloat (DIWSA) and Electronic Target Folders (ETF) for other mission planning systems.

### 3.1 Interface Identification/Diagram.

This IDD specifies the design characteristics of the interface between the TCS and the JSIPS-N system as shown in Figure 3.1-1. The TCS to JSIPS-N (PTW) Interface Block Diagram, Figure 3.1-2, shows the TCS/JSIPS-N interface connectivity via the PTW for the Third FY-97 laboratory demonstration. Figure 3.1-3 shows the TCS/JSIPS-N interface connectivity, also via PTW, to support SAR imagery processing.

The TCS to JSIPS-N interface will adhere to the definition of the Joint Interoperability Interface 2 (JII 2). JII 2 is the top level requirement for the TCS to interface with $C^4I$ Systems. JII 2 does not impose nor levy requirements on the $C^4I$ Systems. The burden is on the TCS to ensure that the TCS architecture, hardware and software is interoperable with the $C^4I$ System.




Bold interface line identifies the interface defined in this document.

**Figure 3.1-1 TCS to JSIPS-N Interface Block Diagram**

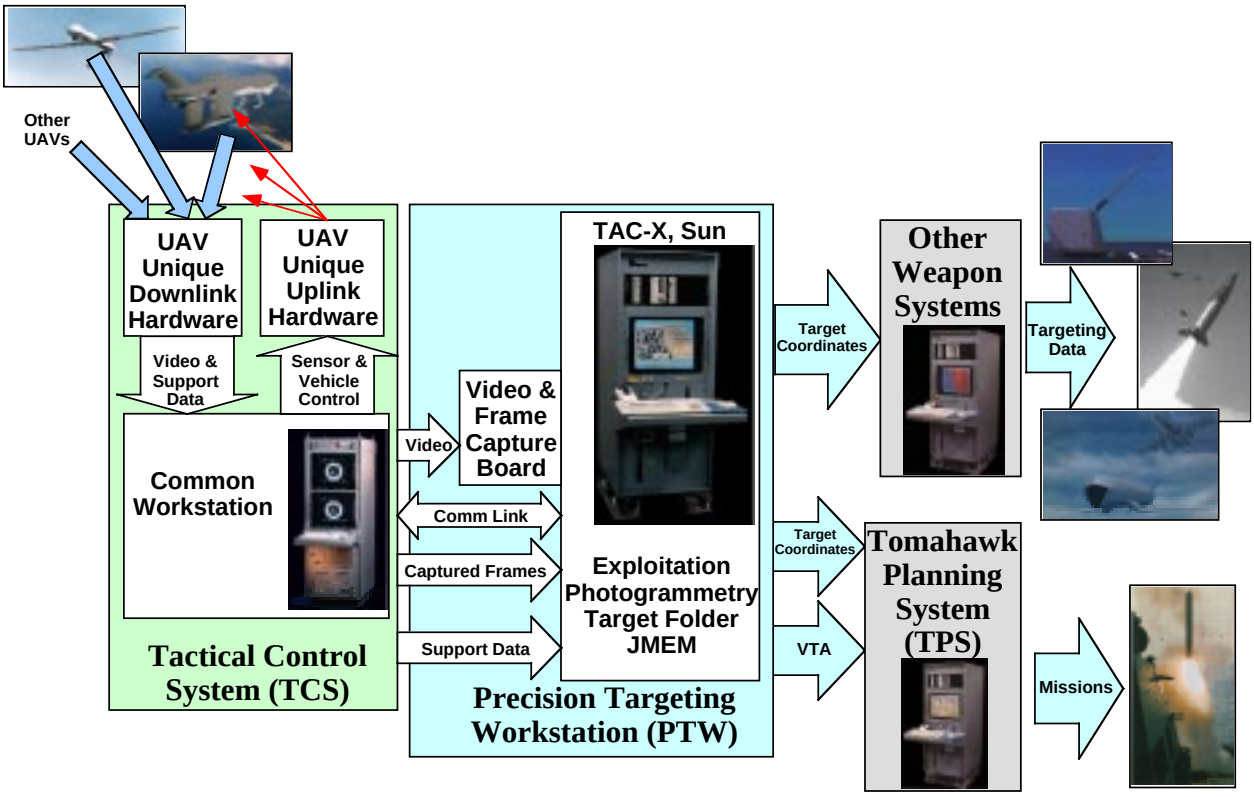



**Figure 3.1-2 TCS to JSIPS-N(PTW) Interface Block Diagram**

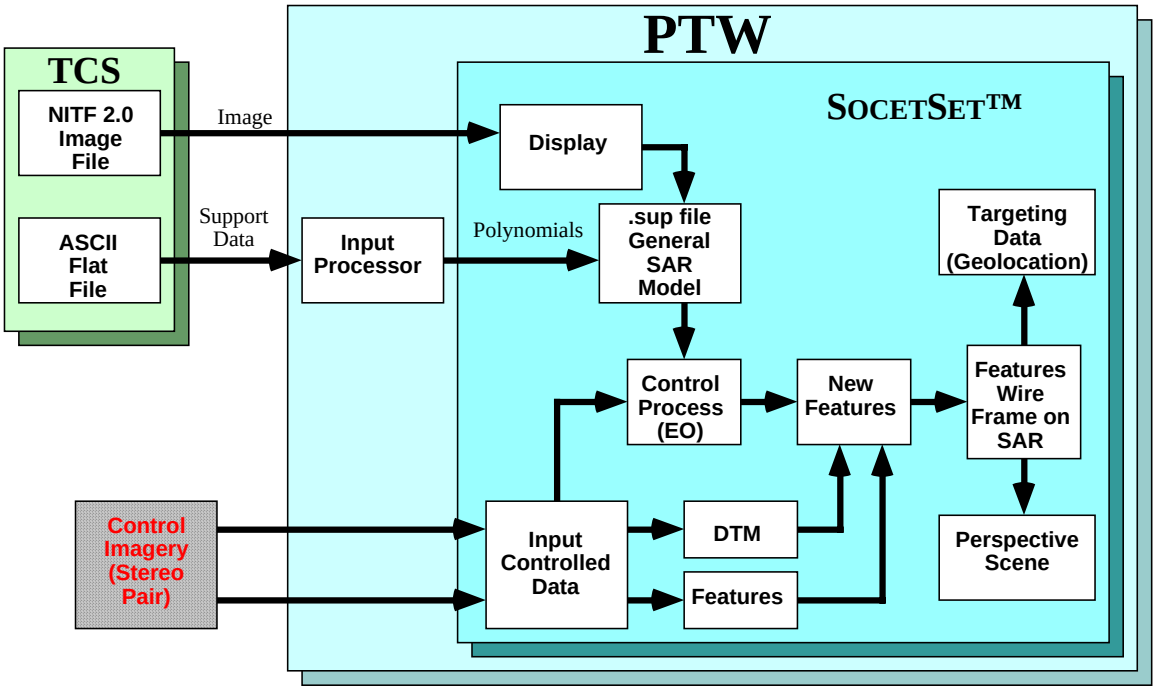



**Figure 3.1-3 Interface from TCS to PTW to Support SAR Imagery Processing**

## 3.2 TCS - PTW Interfaces.

The interface between the TCS and the PTW segment of JSIPS-N is in two major configurations. One set of configurations exists in Operational Testing between the TCS and fielded PTW systems with released software packages. The second set of configurations is used for development testing and the PTW software is modified to perform newly developed functions. As each interface configuration is developed they will be added as an appendix to this document. Figure 3.2-1 summarizes the major elements that are provided in various versions of PTW. These elements control the types of interfaces that can be developed for operational software.

| | PTW Version 1.5 | PTW Version 1.6 | PTW Version 1.7 | PTW Version 2.0† | Open PTW Vers. 0.80 | PTW Version 2.1† | PTW Version 3.0 | PTW Modernization Version |
|---|---|---|---|---|---|---|---|---|
| MATRIX Version | 4.0 | 5.0.2 | 5.1.1 | 4.0 | 5.0.2 | 5.0.2 | 5.1.1 | 5.1.1 |
| SOCETSET Version | 3.0.9 | 3.1.4 | 3.1.4 | 3.0.9 | 3.2/4.0 | 3.1.4 | 3.1.4 | 4.0.2 |
| HPUX Version | 9.0.5 | 9.0.5 | 9.0.5 | 9.0.5 | Solaris 2.5.1 | 9.0.5 | 10.10 | 10.10 |
| Sybase Version | Flat file | Flat file | Flat file | Sybase 10.0 & Flat file | Sybase 10.0 | Sybase 10.0 | Sybase 11.0 | Sybase 11.0 |
| DIWS Version | 2.4 IPF | 2.4.1 IPF | 2.4.1 IPF | 2.4 | N/A | 2.4.1 | 2.4.1 | 2.4.1 |
| Hardware | TAC-3 | TAC-3 | TAC-3 | TAC-3 | Sun Ultra 1 | TAC-3 | TAC-4 | TAC-4 |
| Classification | Unclassified Secret SCI | Secret SCI | Secret SCI | Unclassified Secret SCI | Unclassified | SCI | Secret ? SCI | Secret ? SCI |
| Notes | DIWS Import/Export via IPF | Expand DIWS Import/Export via IPF | New MATRIX for new import capabilities | ETF Managmnt Bridge S/W VSAD I/F to DIWS | Sun H/W SOCETSET Supports SAR Input & Model | New MATRIX New VSAD I/F to DIWS | Colocated w/SPA, New Matrix, New Bridge & E209 | Installation of New Tools and Prototype Capabilities |

† This version will not be delivered to the field
• This version initially is based upon flat file but can be upgraded with a Sybase license
§ Some flat file capability is possible but overall PTW functionality is limited

**Figure 3.2-1 PTW Version Information Summary**

## 3.3 TCS - PTW Interface for PTW Version 1.7.

PTW Version 1.7 has limited interface capability for handling UAV data. The primary interface is via MATRIX 5.0 which allows the import of NITF 2.0 images. The hardware interface is via network or tape connection. The interface also includes notification software that allows TCS and PTW operators to notify each other of transfer of data. This interface is described in detail in Appendix A and is summarized in Figure 3.3-1 below.

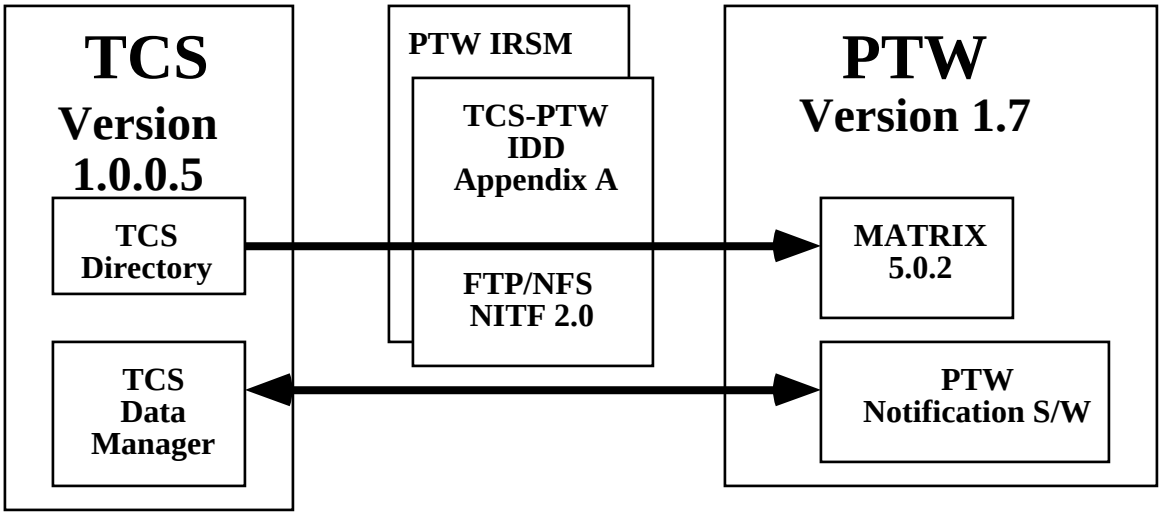



**Figure 3.3-1 TCS to PTW Version 1.7 Interface**

**NOTE:** This interface was demonstrated as part of FLEETEX (4-14 November 1997) on the USS Tarawa (LHA-1).

### 3.4 TCS - PTW Interface for PTW Version 3.1.

PTW Version 3.1 is currently under development and has more robust capabilities to support an interface to UAV data. This interface includes four different types of products: SAR, Digital Imagery (Stills), Precision Targeting Data and CORBA-based handshaking between systems. Figure 3.4-1 is an overview of this capability. This interface is described in Appendix B.

#### 3.4.1 TCS - PTW SAR Interface for Version 3.1.

TCS will provide SAR data to the PTW segment via the NITF 2.0 extension. This interface will take advantage of SocetSet™ 4.0.2 which has an embedded Tactical SAR model. A new extension to NITF 2.0 will be required to handle the support data and the unique characteristics of the TESAR sensor. The data element definition is currently under development. This interface while not operationally robust, will be the first measurement of SAR accuracy and will be the basis of further Tactical SAR development.

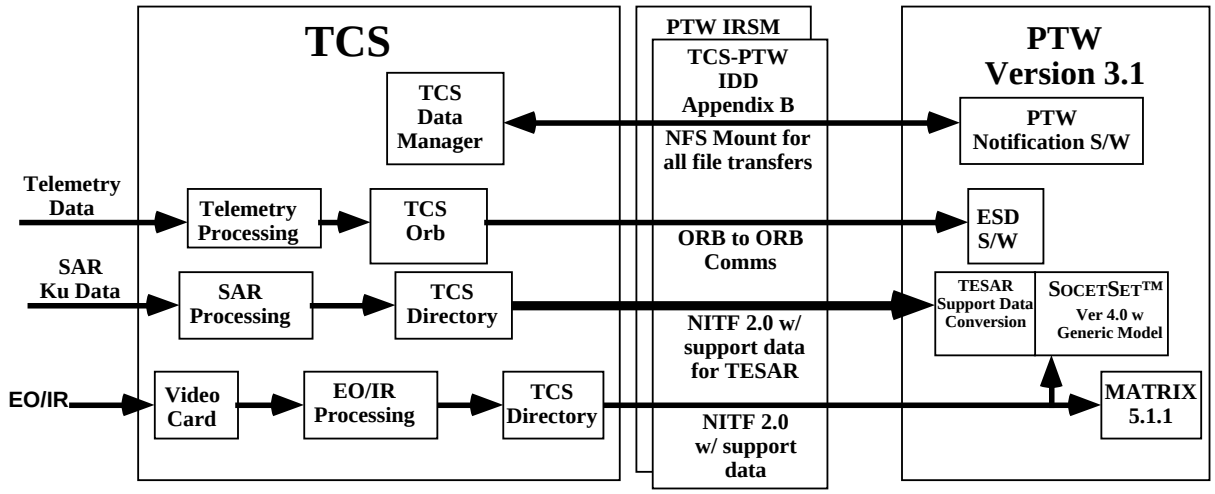



**Figure 3.4-1 TCS to PTW Version 3.1 Interface**

### 3.4.2 Digital Imagery (Stills) Interface for Version 3.1.

TCS will provide NITF 2.0 images to PTW. The SocetSet™ and MATRIX portions of PTW will both be able to import NITF 2.0 images in Version 3.1 of PTW. The NITF 2.0 extensions to be supported by each program are TBD.

### 3.4.3 Precision Targeting Data Interface for Version 3.1.

Additionally, the interface developed for this version will include an import of telemetry data to support the EO Support Data algorithm. This data transfer will be via a CORBA interface and will utilize the TCS data manager for operator to operator handshaking initiating a transfer of information in either a push or pull fashion. Pop-up screens will be developed for this interface and a pull down will be added to PTW software to support this interface. In support of the EO Support Data interface a video capture board is installed in the demonstration system to ensure that the sensor operator is locked on to the target as EO Support Data support data is transmitted.

## 4. Requirements Traceability and Qualification Provisions.

This section defines the traceability of each $C^4I$ requirement in this IDD, as shown in Table 4.0-1 below, to the TCS SSDD requirements specified in the TCS SSDD Version 1.0. This section also defines the qualification methods to be used to ensure that each requirement of this interface has been met. These qualification methods are defined as:

| | | |
|---|---|---|
| D | Demonstration | The operation of the interfacing entities that relies on observable functional operation not requiring the use of instrumentation, special test equipment, or subsequent analysis. |
| T | Test | The operation of the interfacing entities using instrumentation or special test equipment to collect data for later analysis. |
| A | Analysis | The processing of accumulated data obtained from other qualification methods. Examples are reduction, interpretation, or extrapolation of test results. |
| I | Inspection | The visual examination of code, documentation, etc. |
| S | Special | Any special qualification methods such as special tools, techniques, procedures, facilities, and acceptance limits. |

Table 4.0-1 lists each requirement of the TCS-to-JSIPS-N interface with its $C^4I$ IDD requirement number, traceability to the SSDD, the IDD paragraph number where the requirement is found, and the qualification method.

**TABLE 4.0-1**
**TCS-to-JSIPS-N REQUIREMENT TRACEABILITY AND QUALIFICATION METHODS**

| IDD Requirement Number | Requirement | Paragraph Number | TCS Block Impementation | SSDD Req.(s) | Qualification Method(s) |
|---|---|---|---|---|---|
| C4I210001 | Connect via JMCIS Ethernet LAN (ISO/IEC 8802-3: 1996 [ANSI/IEEE Standard 802.3, 1996 Edition]) | A.1 | 0 | TBD | D,I |
| C4I210002 | Transfer NITF 2.0 from TCS to PTW with transaction initiated by TCS | A.2 | 0 | TBD | D,I |
| C4I210003 | Transfer NITF 2.0 from TCS to PTW with transaction initiated by PTW | A.2 | 0 | TBD | D,I |
| C4I210004 | NITF 2.0 files with support data in the Text Field. | A.2 | 0 | TBD | I |
| C4I210005 | Data transfer via Network File System | A.2 | 0 | TBD | D |
| C4I210006 | Data transfer via File Transfer Protocol | A.2 | 0 | TBD | D |

## 5. Notes.

### 5.1 Background Information.

The Genser PTW segment of JSIPS-N runs on a TAC-3/TAC-4 platform and performs the data input and initial analysis of imagery. Alternately, the PTW segment of JSIPS-N can run in a Sun Solaris environment. PTW also generates and maintains an ETF and Mission Task Folder (MTF) database. Analysis of imagery is conducted using the SocetSet™ for precision control of imagery and Matrix for input, annotation and chipping of imagery.

When used with the TCS, the PTW will gather imagery and support data from the TCS, control the imagery using controlled images of the area, attach the imagery to an ETF or MTF and forward the controlled imagery to the Strike Planning Archive (SPA). The information is then disseminated to the various intelligence systems at the Genser level.

The photogrammetric control of SAR imagery requires support data not currently supplied with the SAR NITF 2.0 files. A new document, Airborne Synthetic Aperature Radar Support Data Extensions for the National Imagery Transmission Format, is currently in the approval cycle and has been used as a format for the required support data. Only required data is currently in the file.

A separate standalone program will be used to demonstrate the capability of generating precise target locations from a stream of vehicle data. For test purposes, the stream of data will be assembled in a single file.

## 5.2 Acronyms and Abbreviations.

| | |
|---|---|
| ACS | Aerial Common Sensor |
| ADT | Air Data Terminal |
| AFATDS | Advanced Field Artillery Tactical Data System |
| AFMSS | Air Force Mission Support System |
| alt | altitude |
| AMPS | Army Mission Planning System |
| ASAS | All Source Analysis System |
| ATHS | Automated Target Handoff System |
| ATWCS | Advanced Tomahawk Weapons Control System |
| AV | Air Vehicle |
| | |
| $C^4I$ | Command, Control, Communication, Computer, and Intelligence |
| CA | California |
| CARS | Contingency Airborne Reconnaissance System |
| CCTV | Closed Circuit TeleVision |
| CGS | Common Ground Station |
| CIGSS | Common Imagery Ground/Surface System |
| COMPASS | Common Operational Modeling, Planning, and Simulation Strategy |
| CORBA | Common Object Request Broker Access |
| COSIP | Computer Open Systems Interface Processor |
| | |
| DCGS | Distributed Common Ground Station |
| DID | Data Item Description |
| DII/COE | Defense Information Infrastructure/Common Operating Environment |
| DIWSA | Digital Imagery Workstation Afloat |
| DoD | Department of Defense |
| DoDI | Department of Defense Instruction |
| | |
| EO | Electro Optical |
| ETF | Electronic Target Folder |
| ETRAC | Enhanced Tactical Radar Correlator |
| | |
| ft | feet |
| ft/sec | feet per second |
| | |
| GDE | General Dynamics Electronics |
| GSM | Ground Station Module |
| GUI | Graphical User Interface |
| | |
| HAE | High Altitude Endurance |
| HCI | Human-Computer Interface |

| | |
|---|---|
| IAS | Intelligence Analysis System |
| ID | Identifier or Identification |
| IDD | Interface Design Description |
| IPF | Integrated Processing Facility |
| IR | Infra Red |
| IRS | Interface Requirements Specification |
| JDISS | Joint Deployable Intelligence Support System |
| JII | Joint Interoperability Interface |
| JMCIS | Joint Maritime Command Information System |
| JMEM | Joint Munitions Effectiveness Manual |
| JMF | Joint Message Format |
| JSIPS | Joint Service Imagery Processing System |
| JSIPS-N | Joint Service Imagery Processing System - Navy |
| JSTARS | Joint Surveillance Target Attack Radar System |
| JTA | Joint Technical Architecture |
| LAN | Local Area Network |
| LRIP | Low Rate Initial Production |
| MAE | Medium Altitude Endurance |
| MIES | Modernized Imagery Exploitation System |
| MSL | Mean Sea Level |
| MTF | Mission Task Folder |
| N/A | Not Applicable |
| NITF | National Imagery Transmission Format |
| nm | nautical miles |
| no. | number |
| ORD | Operational Requirements Document |
| PTW | Precision Targeting Workstation |
| SAR | Synthetic Aperture Radar |
| sec | seconds |
| SPA | Strike Planning Archive |
| SPIRIT | Special Purpose Integrated Remote Intelligence Terminal |
| SSDD | System/Subsystem Design Description |
| SSS | System/Subsystem Specification |
| TAMPS | Tactical Aircraft Mission Planning System |
| TBD | To Be Determined |
| TBMCS | Theater Battle Management Core System |
| TAC-3 | Tactical Advanced Computer, 3rd Generation |

| | |
|---|---|
| TCS | Tactical Control System |
| TEG | Tactical Exploitation Group |
| TES | Tactical Exploitation System |
| TUAV | Tactical Unmanned Aerial Vehicle |
| UAV | Unmanned Aerial Vehicle |
| UAV JPO | Unmanned Aerial Vehicle Joint Program Office |
| VMF | Variable Message Format |
| VTA | Visual Task Aid |
| WGS | World Geographic Survey |
| Z | Zulu |

# APPENDIX A
## PTW Version 1.7 Interface
## (FLEETEX Configuration)

### A.1 System Configuration.

The configuration utilizing this interface consists of a TCS Version 1.0.0.5 and a PTW running a modified Version 1.7 of the PTW software, collocated on the same LAN. The JMCIS Ethernet LAN ((ISO/IEC 8802-3: 1996 [ANSI/IEEE Standard 802.3, 1996 Edition])) shall be configured such that the TCS has the ability to transfer files into the PTW. [C4I210001] See Figure A.1-1 below.

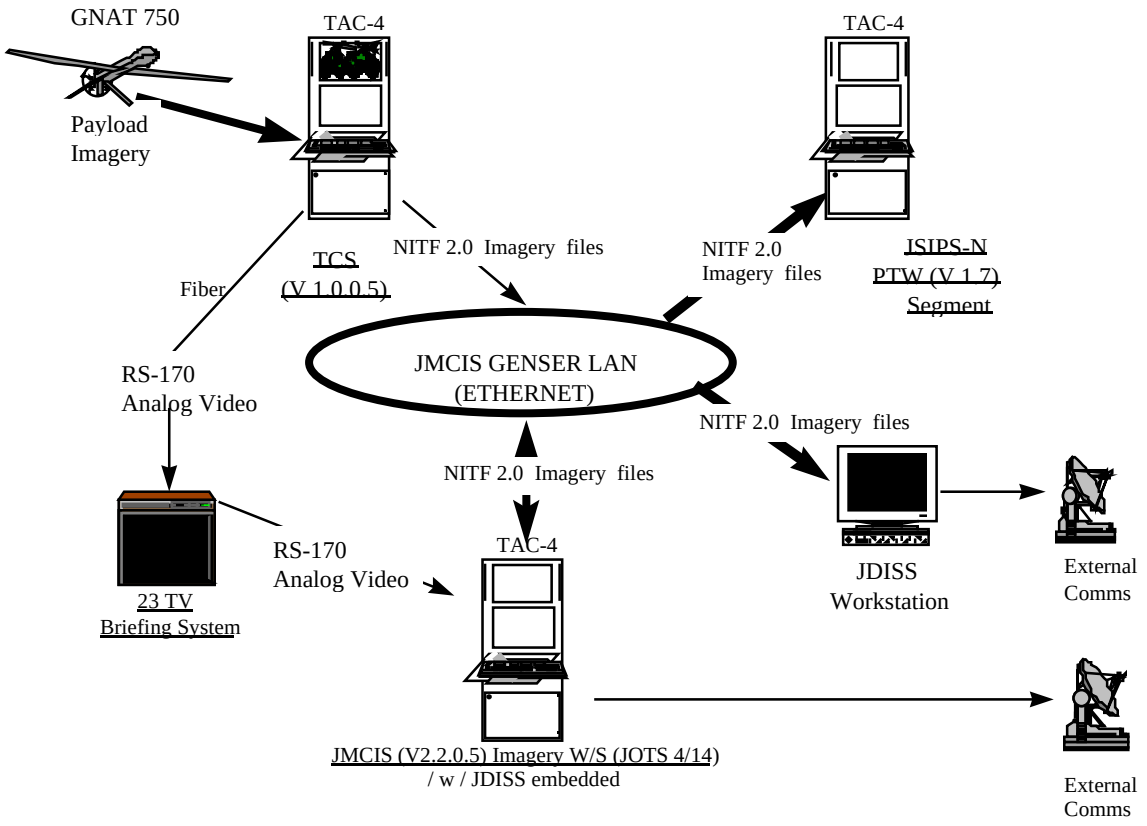



**Figure A.1-1. USS Tarawa (LHA-1) FLEETEX C$^4$I Configuration**

## A.2 Data Transfer.

Image files from the UAV downlinked data (GNAT 750 used as a Predator UAV surrogate) shall be transferred in NITF 2.0 format into the PTW using the transfer function installed on the TCS [C4I210002] or by selection of the UAV button from the PTW Tools menu. [C4I210003] The NITF 2.0 text field shall contain support data in an ASCII file as detailed in A.3.2. [C4I210004] A default transfer directory has been created on the PTW. Data transfer shall be via Network File System [C4I210005] or File Transfer Protocol. [C4I210006]

### A.2.1 TCS to PTW Transfer - from TCS.

Transfer of image files can be initiated from the TCS using the menu shown in Figure A.2.1-2. The file to be transferred is selected on the left side of the window. When the File Transfer to PTW pushbutton is selected the file is copied to the default directory on the PTW.

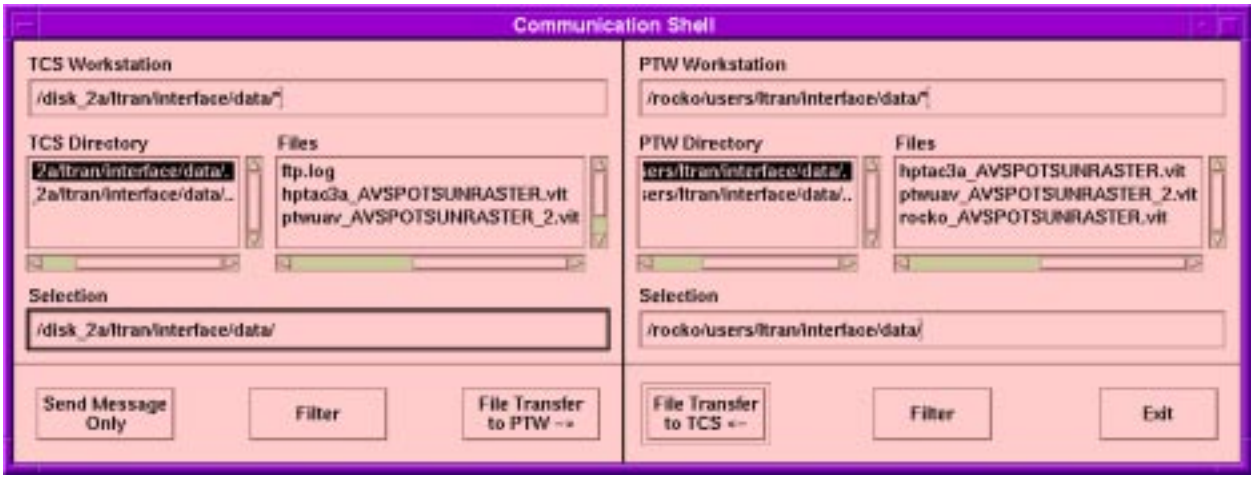



**Figure A.2.1-2. TCS File Transfer Menu**

### A.2.2 TCS to PTW Transfer - from PTW.

When UAV is selected from the Tools Menu of the PTW, the Initial PTW Menu shown in Figure A.2.2-1 appears. Currently only the MAE data files are available. Selection of any of the Process pushbuttons will cause the PTW File Selection Menu shown in Figure A.2.2-2 to be displayed.

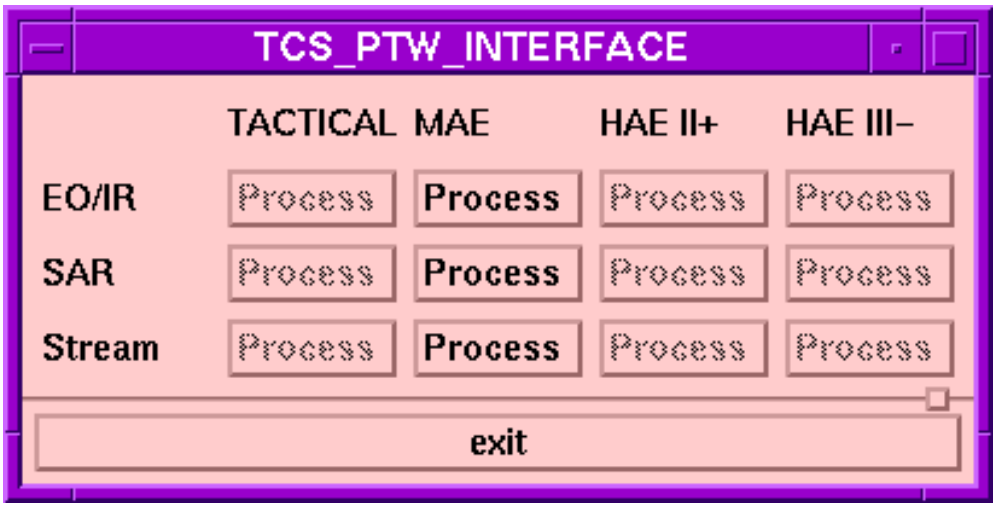



**Figure A.2.2-1. Initial PTW Menu**

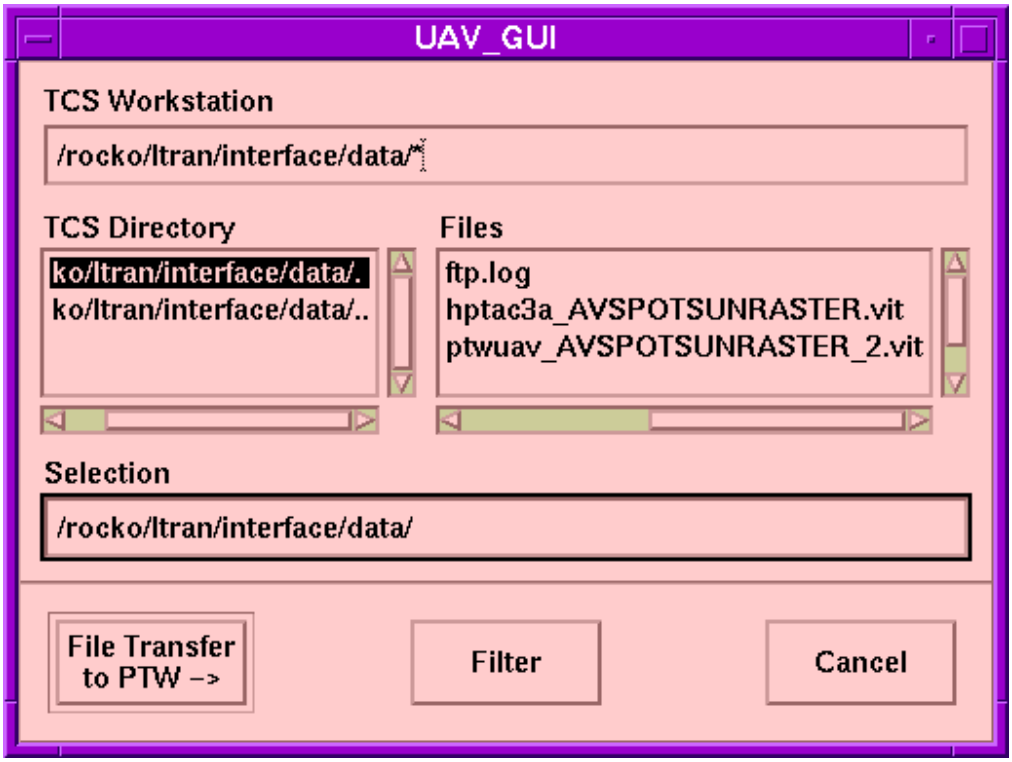



**Figure A.2.2-2. PTW File Selection Menu**

The file desired is selected from the TCS directories and the File Transfer to PTW pushbutton is selected. The file is then transferred to the default directory on the PTW.

## A.3 PTW Operations.

To demonstrate the capability of the TCS to interface with the PTW the following operations will be performed.

### A.3.1 File Import.

Using the MATRIX tool from the PTW menu the file transferred from the TCS will be imported from the transfer directory into the system using the NITF 2.0 Import function. The resulting .ntf file will reside in the /matrix/images directory.

### A.3.2 Image Review.

The image will be loaded into the MATRIX screen. Annotation and graphics will be added using the MATRIX tools. The areas of interest will be chipped out and saved using the Scissors tool. Support data will be part of the NITF 2.0 file as a file stored in the text field. Using Matrix, the file can be opened and viewed, and the data associated with the image can be used to support targeting functions. See Figure A.3.2-1, NITF Support Data, containing the fields and example data.

```
AV_Tail_Nbr =1
Mission_ID_Nbr = 0
AV_Position_Source = 0
AV_Lat_Deg = 3.30002980000000E+01
AV_Lon_Deg = -1.16803290000000E+01
AV_Alt_Ft_Msl=9837
AV_True_Heading = 1.500000000000000E+01
AV_Ground_Track_Deg = 0.00000000000000E+01
AV_Next_Waypoint =1
AV_Indicated_Airspeed = 150
GPS_Time_Wk = 888
GPS_Time_Sec = 13903
AV_Active_Sensor = 0
EOIR_Pointing_Mode = 0
EOIR_Pointing_Azimuth = 0.00000000000000E+00
EOIR_Pointing_Depression = 0.00000000000000E+00
EOIR_Fixed_Pt_Lat = 3.29999580000000E+01
EOIR_Fixed_Pt_Long = -1.16803061000000E+02
EO2_Zoom_Setting = 0
IR_Fov = 14
AV_Roll_Angle = 0.00000000000000E+00
AV_Pitch_Angle = 0.00000000000000E+00
AV_Yaw_Rate = 0.00000000000000E+00
AV_Vertical_Speed = 0
AV_Normal_Accel = 0.00000000000000E+00
```

**Figure A.3.2-1 NITF Support Data**

### A.3.3 Target Folders.

On the PTW a Target Folder will be created and the chips developed in Paragraph 3.2 will be added to the target folder as Visual Task Aids (VTAs).

# APPENDIX B
# PTW Version 3.1 Interface (Proposed)

## B.1 System Configuration.

The configuration utilizing this interface consists of a TCS (version TBD) and a PTW. This configuration will be used for future demonstrations of the interface between TCS and JSIPS.

### B.1.1 TCS.

The TCS will have added software to control the transfer of files to the PTW and to notify the PTW of file availability. Software to provide CORBA capability will be installed. To test the Precision Targeting mode a function to assemble telemetry data into a file useable by the Precision Target demonstration software will be installed.

### B.1.2 PTW.

The PTW will have a preliminary version of Version 3.1 software. It will consist of the Version 2.1 baseline with a UAV communications function added. It will contain MATRIX Version 5.1.1 and SocetSet™ Version 4.0 with the generic SAR model installed. The PTW Tools menu will be modified to add UAV specific entries. Two independent applications will be added to the PTW software. One will process the SAR Support Data file and insert the data into the SocetSet™ .sup file. The other application will process the Precision Targeting data files to provided a more precise target location.

## B.2 Data Transfer.

Data transfers between the TCS and the PTW can be separated into four areas.

### B.2.1 Digital Imagery (Still).

Digital Imagery (Still) consists of single frames of imagery captured from the sensor down-link. The imagery in the file maybe E/O, IR or SAR imagery.

#### B.2.1.1 Type of Interface.

Digital Imagery (Still) will be transferred from TCS to PTW in NITF 2.0 format.

#### B.2.1.2 Individual Data Element Characteristics.

The individual SAR and EO/IR data element characteristics are listed in the following paragraphs.

##### B.2.1.2.1 SAR Individual Data Element Characteristics.

SAR elements are still in the process of being defined based upon an on-going SAR study.

#### B.2.1.2.2 EO/IR Individual Data Element Characteristics.

Digital Imagery (Still) EO/IR data elements within the file will be as specified in NITF Specification MIL-STD-2500A. No approved extensions are currently required. This interface was shown in Demonstration #2. As additional support data requirements are identified, this interface may be modified to include approved support data extensions.

#### B.2.1.3 Data Element Assembly Characteristics.

Data Elements will be assembled as specified in in MIL-STD-2500A and as amended by the specific approved applicable extensions. The EO/IR input is as specified in in MIL-STD-2500A. As additional support data requirements are approved, this interface may be modified to assemble the required support data extensions.

#### B.2.1.4 Communication Methods Characteristics.

Digital Imagery (Still) will be transferred between the TCS and PTW via the Local Area Network (LAN) connecting the two systems.

#### B.2.1.5 Other Characteristics.

Support data may be contained in the fields of the NITF 2.0 header or in negotiated extensions within the file.

### B.2.2 Support Data Files.

Support Data Files are required for control and triangulation of the associated image. Data elements are dependent on the type of image (i.e. SAR, E/O, IR). Nominally, the support data files will include UAV position, velocity, attitude, sensor attitude, image center(target) location, slant range, and time tags.

#### B.2.2.1 Type of Interface.

Support data is transferred in files as described in the following paragraphs.

#### B.2.2.2 Individual Data Element Characteristics.

a. Individual Data Element Characteristics of the SAR Support Data Files are TBD.
b. Individual Data Element Characteristics of the EO/IR Support Data Files are TBD.

#### B.2.2.3 Data Element Assembly Characteristics.

a. The SAR Support Data Elements characteristics are TBD.

b. The EO/IR Support Data Element Assembly characteristics are TBD.

#### B.2.2.4 Communication Methods Characteristics.

Support Data Files will be transferred between TCS and PTW via the Local Area Network connecting the two systems.

#### B.2.2.5 Other Characteristics.

Support Data Files will have the same filename as the image they support except they will have a ".dat" extension.

### B.2.3 Real-time Status Information.

Real-time Status Information will be used to coordinate operations between the TCS and PTW. File availability information and the success or failure of transfer operations are typical data sent between systems as Real-time Status Information.

#### B.2.3.1 Type of Interface.

Real-time Status Information is transferred via sockets established by the Graphical User Interfaces (GUI) running on each system.

#### B.2.3.2 Individual Data Element Characteristics.

The elements of the structure passed from TCS to PTW are:

```
int     NumFiles;
char    Filename[256];
```

If NumFiles = 0 then the file, Filename, is available for transfer to the PTW.
If NumFiles = 1 then file, Filename has been pushed to the PTW by the TCS.

#### B.2.3.3 Data Element Assembly Characteristics.

The structure detailed in Paragraph 2.4.2 is passed as a message from the TCS to the PTW.

#### B.2.3.4 Communication Methods Characteristics.

Communications between the TCS and PTW will be via the Local Area Network using the standard socket to socket method of process to process communications.

#### B.2.3.5 Other Characteristics.

The structure will allow for multiple files to be transferred in later revisions.

### B.2.4 Precision Targeting Data.

Precision Targeting Data is a series of vehicle positions and sensor pointing angles used by the PTW to precisely locate a potential target. The TCS will provide a file with data as detailed in the following paragraphs.

#### B.2.4.1 Type of Interface.

Precision Targeting Data Files will be transferred between TCS and PTW via the Local Area Network connecting the two systems.

#### B.2.4.2 Individual Data Element Characteristics.

Support data needed for near-real-time EO/IR targeting is contained in the Tactical Control System Segment to Air Vehicle Specific Segment Standard Interface Design Description. One needed data item is missing, the EO/IR Fixed Point Altitude used to calculate EO/IR image center Fixed Pointing Latitude and Longitude (fields 36 and 37). The UAV System Status message field items are listed in Table B.2.4.2-1. The normal data rate is 1 Hz. The normal data size is 228 bytes.

The support data needed for near-real-time targeting should be assembled into a single file with a file name that identifies the target that was centered in the camera during data collection. As supporting information, it is requested that a frame captured image of the target be provided. This allows the proper correlation of the data with the appropriate target.

Table B.2.4.2-2 is a data subset that is sufficient for near-real-time targeting. Field numbers are listed in the order of priority but it highly desireable to have all fields up to field 37 plus the EO/IR Fixed Pointing Altitude.

| Field Number | Field Type | Description |
|---|---|---|
| 1 | Unsigned Long<br>Constant = 1 | Message Identifier<br>1 = UAV System Status |
| 2 | Unsigned Long | PPO Number, Source<br>1 = PPO 1<br>2 = PPO 2 |
| 3 | Unsigned Long | UAV Tail Number/Id<br>(1..999) |
| 4 | Unsigned Long | Mission ID Number<br>0 = PPO Modified Mission<br>1..255 |
| 5 | WGS | UAV Latitude<br>WGS * 1,000,000 (-90,000.000.. +90,000,000) |
| 6 | WGS | UAV Longitude<br>WGS * 1,000,000 (-180,000.000.. +180,000,000) |
| 7 | Long | UAV Altitude, mean above sea level, GPS<br>Feet (-3000..60000) |
| 8 | Degrees | UAV Heading, True North<br>Degrees * 100 (0..35999) |
| 9 | Degrees | UAV Course, Ground Track<br>Degrees * 100 (0.35999) |
| 10 | Degrees | UAV Measured Wind Heading<br>Degrees * 100 (0..35999) |
| 11 | Unsigned Long | UAV Measured Wind Speed<br>Knots (0..255) |
| 12 | Unsigned Long | UAV Next Waypoint # (1..999) |
| 13 | Signed Long | UAV Climb Rate<br>Feet / Sec (-3000..+3000) |
| 14 | Unsigned Long | UAV Indicated Air Speed<br>Knots (0..200) |
| 15 | Unsigned Long | UAV Fuel Remaining, Indicated<br>Lbs. * 10 (0..8000) |
| 16 | Unsigned Long | Loiter Pattern Mode<br>0 = None - no pattern<br>1 = N-Gon (6 points)<br>2 = Figure 8<br>3 = Area Search Box |
| 17 | Unsigned Long | Diameter / Height Nautical Miles * 1000<br>N-Gon, Diameter (3000 .. 10000)<br>Figure 8, Height (3000 .. 50000)<br>Area Search Height (3000 .. 50000) |

Table B.2.4.2-1

| Field Number | Field Type | Description |
|---|---|---|
| 18 | Unsigned Long | Length, Nautical Miles * 1000<br>N-Gon, not used<br>Figure 8, Height (3000 .. 50000)<br>Area Search Height (3000 .. 50000) |
| 19 | Unsigned Long | Time Remaining in Loiter Pattern (minutes) |
| 20 | Unsigned Long | Current GPS Reference Time, Weeks<br>(week zero is Jan. 6, 1980) |
| 21 | Unsigned Long | Current GPS Reference Time, Seconds<br>(seconds since midnight, Sunday) |
| 22 | Unsigned Long | UAV Communication Link Select<br>0 = LOS<br>1 = UHF Satcom<br>2 = WB-CDL Satcom |
| 23 | Unsigned Long | UAV Satcom Channel Number (0..100) |
| 24 | Unsigned Long | UAV Communication Link Status<br>0 = Lost Link<br>1 = OK |
| 25 | Unsigned Long | IAV VCR Video Source<br>0 = Nose Camera 1<br>1 = EO 2 - Daylight<br>2 = FLIR<br>3 = EO 1 - Spotter<br>4 = Spare, 1<br>5 = Spare, 2<br>6 = Receiver 3 |
| 26 | Unsigned Long | UAV VCR State<br>0 = Stop<br>1 = BOT (Beginning of Tape)<br>2 = EOT (End of Tape)<br>3 = Search Rewind<br>4 = Search Forward<br>5 = Rewind<br>6 = Fast Forward<br>7 = Play<br>8 = Pause, Standby<br>9 = Record<br>10 = Null 3<br>11 = Null 4<br>12 = Still<br>13 = Null 5<br>14 = Interval Record<br>15 = Counter Reset |

Table B.2.4.2-2

| Field Number | Field Type | Description |
|---|---|---|
| 27 | Signed Long | VCR Counter, Seconds (-7200..+7200) |
| 28 | Unsigned Long | UAV Video Source, Datalink Primary<br>(Primary video link. Typically used for nose camera in LOS link operation and for payload data in non LOS operation)<br>0 = Nose Camera 1 (normally selected, for LOS)<br>1 = EO 2 - Daylight<br>2 = FLIR<br>3 = EO 1 - Spotter<br>4 = Spare, 1<br>5 = Spare, 2<br>6 = Receiver 3<br>7 = UAV VCR |
| 29 | Unsigned Long | UAV Video Source, Datalink Secondary<br>(Primary payload data for LOS link operation.)<br>0 = Nose Camera 1<br>1 = EO 2 - Daylight<br>2 = FLIR<br>3 = EO 1 - Spotter<br>4 = Spare, 1<br>5 = Spare, 2<br>6 = Receiver 3<br>7 = UAV VCR |
| 30 | Unsigned Long | UAV Active Sensor<br>0 = Nose Camera 1<br>1 = EO 2 - Daylight<br>2 = FLIR<br>3 = EO 1 - Spotter<br>4 = SAR<br>5 = Spare<br>6 = Receiver 3<br>7 = UAV VCR |
| 31 | Unsigned Long | EO/IR State, Power<br>0 = Off<br>1 = On |
| 32 | Unsigned Long | EO/IR IIRS number<br>IIRS (0 .. 9) |
| 33 | Unsigned Long | EO/IR Pointing Mode<br>0 = Position Reference<br>1 = Position Fixed<br>2 = Slew<br>3 = Bright Spot |
| 34 | Unsigned Long | EO/IR Pointing Azimuth (Ref to north heading)<br>Degrees * 100 (-18000..+18000) |

| Field Number | Field Type | Description |
|---|---|---|
| 35 | Unsigned Long | EO/IR Pointing Depression (Ref. to aircraft)<br>Degrees * 100 (-1800..+18000) |
| 36 | WGS | EO/IR Fixed Pointing Latitude, Center Point<br>WGS * 1,000,000(-90,000,000..+90,000,000) |
| 37 | WGS | EO/IR Fixed Pointing Longitude, Center Point<br>WGS * 1,000,000(-180,000,000..+180,000,000) |
| 38 | Unsigned Long | Ellipsoid Radii Major Axis<br>Feet * 10 |
| 39 | Unsigned Long | Ellipsoid Radii Minor Axis<br>Feet * 10 |
| 40 | Unsigned Long | E01 Zoom Setting (Currently Fixed)<br>Spare |
| 41 | Unsigned Long | EO1 Iris Mode (Currently Fixed)<br>0 = Manual<br>1 = Auto |
| 42 | Unsigned Long | E01 Iris Setting (Currently Fixed)<br>(0..100) |
| 43 | Unsigned Long | EO2 Focus, Position<br>(0..100) |
| 44 | Unsigned Long | EO2 Zoom Setting, Position (0.100) |
| 45 | Unsigned Long | EO2 Iris Mode<br>0 = Manual<br>1 = Auto |
| 46 | Unsigned Long | EO2 Iris Setting<br>(0..100) |
| 47 | Unsigned Long | EO2 Focus, Position<br>(0..100) |
| 48 | Unsigned Long | IR FOV 2X<br>0 = None<br>1 = 2X |
| 49 | Unsigned Long | IR FOV<br>0 = 19 MM<br>1 = 70 MM<br>2 = 280 MM |
| 50 | Unsigned Long | IR Focus, Position<br>(0..100) |
| 51 | Unsigned Long | IR Iris Mode<br>0 = Manual<br>1 = Auto |
| 52 | Unsigned Long | IR Iris Setting<br>(1..5) |

Table B-1.4

| Field Number | Field Type | Description |
|---|---|---|
| 53 | Unsigned Long | IR Image Polarity<br>0 = white<br>1 = black hot |
| 54 | Unsigned Long | SAR State<br>0 = Power Off<br>1 = Extended Bit / Calibration<br>2 = Standby<br>3 = Operate |
| 55 | Unsigned Long | SAR IRS number, Required only when SAR is in Operate state<br>IIRS (0..9) |
| 56 | Unsigned Long | SAR Transit<br>0 = Disabled)<br>1 = Enabled |
| 57 | Unsigned Long | Checksum |

Table B-1.5

| Field Number | Field Type | Description |
|---|---|---|
| 20 | Unsigned Long | Current GPS Reference Time, Weeks<br>(week zero is Jan. 6, 1980) |
| 21 | Unsigned Long | Current GPS Reference Time, Seconds<br>(seconds since midnight, Sunday) |
| 4 | Unsigned Long | Mission ID Number<br>0 = PPO Modified Mission<br>1..255 |
| 5 | WGS | UAV Latitude<br>WGS * 1,000,000 (-90,000.000.. +90,000,000) |
| 6 | WGS | UAV Longitude<br>WGS * 1,000,000 (-180,000.000.. +180,000,000) |
| 7 | Long | UAV Altitude, mean above sea level, GPS<br>Feet (-3000..60000) |
| 8 | Degrees | UAV Heading, True North<br>Degrees * 100 (0..35999) |
| 9 | Degrees | UAV Course, Ground Track<br>Degrees * 100 (0.35999) |
| 30 | Unsigned Long | UAV Active Sensor<br>0 = Nose Camera 1<br>1 = EO 2 - Daylight<br>2 = FLIR<br>3 = EO 1 - Spotter<br>4 = SAR<br>5 = Spare<br>6 = Receiver 3<br>7 = UAV VCR |
| 32 | Unsigned Long | EO/IR IIRS number<br>IIRS (0 .. 9) |
| 33 | Unsigned Long | EO/IR Pointing Mode<br>0 = Position Reference<br>1 = Position Fixed<br>2 = Slew<br>3 = Bright Spot |
| 34 | Unsigned Long | EO/IR Pointing Azimuth (Ref to north heading)<br>Degrees * 100 (-18000..+18000) |
| 35 | Unsigned Long | EO/IR Pointing Depression (Ref. to aircraft)<br>Degrees * 100 (-1800..+18000) |
| 36 | WGS | EO/IR Fixed Pointing Latitude, Center Point<br>WGS * 1,000,000(-90,000,000..+90,000,000) |
| 37 | WGS | EO/IR Fixed Pointing Longitude, Center Point<br>WGS * 1,000,000(-180,000,000..+180,000,000) |

Table B-2.1

| Field Number | Field Type | Description |
|---|---|---|
| (Not Listed) | Long | EO'/IR Fixed Pointing Altitude, mean above sea level, feet |
| 42 | Unsigned Long | E01 Iris Setting (Currently Fixed)<br>(0..100) |
| 43 | Unsigned Long | EO2 Focus, Position<br>(0..100) |
| 44 | Unsigned Long | EO2 Zoom Setting, Position (0.100) |
| 46 | Unsigned Long | EO2 Iris Setting<br>(0..100) |
| 47 | Unsigned Long | EO2 Focus, Position<br>(0..100) |
| 48 | Unsigned Long | IR FOV 2X<br>0 = None<br>1 = 2X |
| 49 | Unsigned Long | IR FOV<br>0 = 19 MM<br>1 = 70 MM<br>2 = 280 MM |
| 50 | Unsigned Long | IR Focus, Position<br>(0..100) |
| 52 | Unsigned Long | IR Iris Setting<br>(1..5) |
| 53 | Unsigned Long | IR Image Polarity<br>0 = white<br>1 = black hot |
| 54 | Unsigned Long | SAR State<br>0 = Power Off<br>1 = Extended Bit / Calibration<br>2 = Standby<br>3 = Operate |

Table B.2.4.2-2

**B.2.4.3 Data Element Assembly Characteristics.**

The data elements described above in either the format of Table B-1 or B-2 will be collected into a records. These records will be assembled for transfer from TCS to PTW. The number of records may be from ten to 200. The files will be uniquely identified to be associated with a target and an NITF 2.0 frame captured image will be provided and associated with these elements.

**B.2.4.4 Communication Methods Characteristics.**

Precision Targeting files will be transferred between TCS and PTW via the Local Area Network connecting the two systems.

#### B.2.4.5 Other Characteristics.

File length (number of position reports) is variable. The greater the number of position reports in the file the more accurate the resultant target position will be.

## B.3 PTW Operations.

The following paragraphs describe the operations to be performed on the PTW during a demonstration of this capability.

### B.3.1 Digital Imagery (Still).

Using the communications software added to the TCS Digital Imagery in NITF 2.0 format will be transferred to the PTW. Using the MATRIX import function the images will be brought into MATRIX. Annotations and graphics will be added and areas of interest chipped from the images. The chips will then be transferred to target folders as Visual Task Aids. If controlled imagery for the area covered by the image is available the images will be moved into SocetSet™ and controlled.

### B.3.2 SAR Data.

TBD

### B.3.3 Precision Targeting Data.

The Precision Targeting data file will be sent to the PTW and the Precision Targeting application will be selected from the menu. When the file is selected the application will process the file and provide the results in a popup window.